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06MAT31

Third Semester B.E. Degree Examination, June/July 2011
Engineering Mathematics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Find a Fourier series to represent $f(x) = x - x^2$ from $x = -\Pi$ to $x = \Pi$ and deduce that $\frac{\Pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots$ (07 Marks)

b. If $f(x) = \begin{cases} x & 0 < x < \Pi/2 \\ \Pi - x & \Pi/2 < x < \Pi \end{cases}$

show that i) $f(x) = \frac{4}{\Pi}\left[\sin x - \frac{1}{3^2}\sin 3x + \frac{1}{5^2}\sin 5x - \ldots\ldots\right]$

ii) $f(x) = \frac{\Pi}{4} - \frac{2}{\Pi}\left[\frac{1}{1^2}\cos 2x + \frac{1}{3^2}\cos 6x + \frac{1}{5^2}\cos 10x + \ldots\ldots\right]$ (07 Marks)

c. Obtain the Fourier series neglecting the terms higher than first harmonic.

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(06 Marks)

2 a. Find the Fourier transform of the function $f(x) = \begin{cases} x, & |x| \le \alpha \\ 0 & |x| > \alpha \end{cases}$ where 'α' is a positive constant. (06 Marks)

b. Solve the integral equation $\int_0^\infty f(\theta)\cos \alpha\theta\, d\theta = \begin{cases} 1-\alpha & 0 \le \alpha \le 1 \\ 0 & \alpha > 0 \end{cases}$

Hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2} dt$ (08 Marks)

c. Find the finite Fourier sine transform of $f(x) = 2x$ in $0 \le x \le 4$. (06 Marks)

3 a. Form the Partial Differential equation by eliminating the arbitrary function from the equation $F(xy + z^2, x + y + z) = 0$ (06 Marks)

b. Solve: $xp - yq = y^2 - x^2$. (07 Marks)

c. Solve $py^3 + qx^2 = 0$ by the method of separation of variable. (07 Marks)

4 a. Derive one dimensional heat equation. (07 Marks)

b. Find the deflections of a vibrating string of unit length fixed ends with initial velocity zero and initial deflections $f(x) = k(\sin x - \sin 2x)$. (06 Marks)

c. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to the conditions

$u(0, y) = u(l, y) = u(x, 0) = 0$ and $u(x, a) = \sin\frac{n\Pi x}{l}$. (07 Marks)

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PART – B

5 a. Find the real root of the equation $xe^x = 2$ correct to three decimal places using Newton-Raphson method. **(07 Marks)**

b. Employ Gauss-Siedel iteration method to solve:

$20x + y - 2z = 17$

$2x - 3y + 20z = 25$

$3x + 20y - z = 18$

Carryout 3 iterations. **(07 Marks)**

c. Using Power method find the dominant eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ **(06 Marks)**

6 a. Using suitable interpolation formula, find the number of students who obtained marks between 40 and 45. **(07 Marks)**

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

b. Using divided difference formula to find f(x) given data hence find f(4). **(07 Marks)**

x	0	2	3	6
f(x)	-4	2	14	158

c. Using Simpson's $\frac{1}{3}$rd Rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. **(06 Marks)**

7 a. State and prove Euler's equation. **(07 Marks)**

b. Solve the variation problem $\sigma \int_0^1 (y^2 + x^2 y^1) dx = 0, y(0) = 0, y(1) = 1$. **(06 Marks)**

c. Find the path in which a particle in the absence of friction will slide from one point to another in the shortest time under the action of gravity. **(07 Marks)**

8 a. Find the z-transform of coshn θ and sinhn θ. **(06 Marks)**

b. Find the inverse z-transform of $\frac{z^3 - 20z}{(z-3)^2(z-4)}$. **(07 Marks)**

c. Solve: $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using z-transform. **(07 Marks)**

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06ES32

Third Semester B.E. Degree Examination, June/July 2011
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. Missing data may be assumed suitably.

PART – A

1 a. Define the following pertaining to the diode:
i) Dynamic resistance ii) Diffusion capacitance and iii) Reverse recovery time. **(06 Marks)**

b. Discuss the approximate and piecewise linear model of a diode. **(06 Marks)**

c. Sketch the output voltage $v_0(t)$ for the circuit shown in Fig.Q1(c), if $v_i(t) = 50 \sin\omega t$. Assume diodes D_1 and D_2 as ideal. **(08 Marks)**

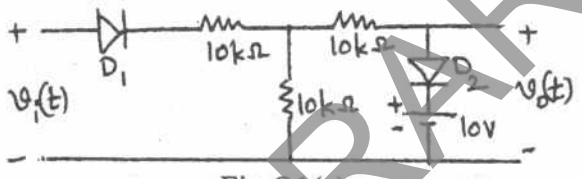

Fig.Q1(c)

2 a. What is biasing of a transistor? Explain the factors that affect selection of Q-point anywhere in the active region for the transistor to operate as an amplifier. **(06 Marks)**

b. What is bias stabilization? Discuss the stability of the operating point against variation in its parameters. **(06 Marks)**

c. Design a voltage divider bias circuit for the following specifications:
$V_{CC} = 15$ V, $V_{CE} = 7.5$ V, $I_C = 2$ mA, $S(I_{CO}) \leq 15$, $\beta = 100$ and $V_E = 1.5$ V. **(08 Marks)**

3 a. For the CE amplifier circuit derive the expression for A_I , Z_i , A_V and Y_o in terms of transistor h-parameters. **(10 Marks)**

b. For the circuit shown in Fig.Q3(b), find A_I , R_i , A_V and Z_o. The transistor h-parameters are $h_{ie} = 1$ kΩ, $h_{re} = 2\times10^{-4}$, $h_{fe} = 85$ and $h_{oe} = 2$ μʊ. **(10 Marks)**

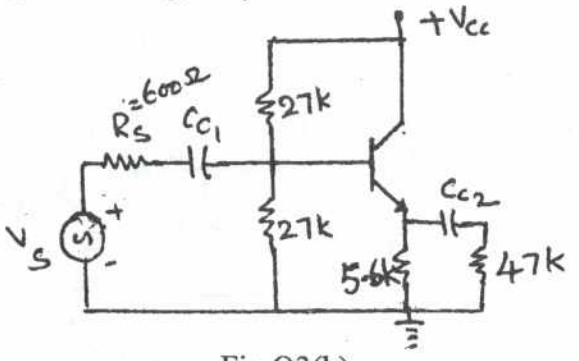

Fig.Q3(b)

4 a. Derive the expression for Miller's effect capacitances. **(06 Marks)**

b. Derive the expression for overall lower and higher cut off frequencies of multistage amplifier. **(06 Marks)**

c. At $I_C = 1$ mA and $V_{CE} = 10$V, a certain transistor data shows $C_c = C_{b'c} = 3$ pF, $h_{fe} = 200$ and $\omega_t = -500$ mrad/sec. Calculate g_m , $r_{b'e}$, $c_{b'e}$ and ω_β. **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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PART – B

5 a. What is an emitter follower circuit? Discuss Darlington emitter following circuit. **(08 Marks)**

b. Fig.Q5(b) shows a circuit schematic of a feedback amplifier for which the parameters are $A = -2000$, $\beta = 1/150$, $R_s = R_E = 1\ k\Omega$, $R_C = 3\ k\Omega$, $h_{ie} = 2\ k\Omega$, $h_{fe} = 200$ and $h_{re} = h_{oe} = 0$. Show that $v_i = -200\ [V_s - V_f]$. Calculate $A_{V_f} = \frac{V_0}{V_s}$ **(12 Marks)**

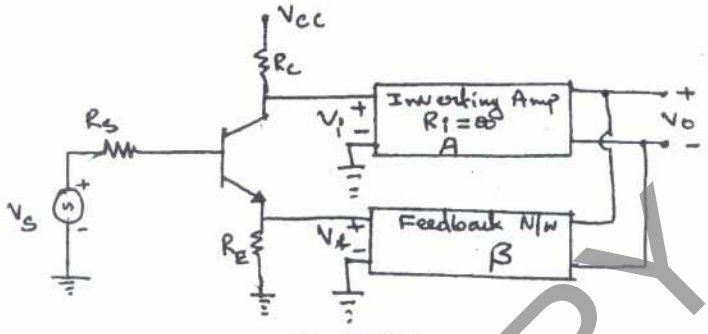

Fig.Q5(b)

6 a. Explain the operation of transformer coupled class A power amplifier. **(06 Marks)**

b. Show that maximum efficiency of the push pull class B power amplifier circuit is 78.5%. **(06 Marks)**

c. A complementary symmetry push pull amplifier is operated using $V_{CC} = \pm 10V$ and deliver power to a load $R_L = 5\ \Omega$. Calculate i) Maximum power output ii) Power rating of transistors iii) DC input at maximum power output. **(08 Marks)**

7 a. Obtain the Brakhausen criterion for operation of the oscillator using basic feedback circuit and hence, explain the operation of the oscillator. **(08 Marks)**

b. With neat circuit diagram, explain the operation of tuned oscillator. **(06 Marks)**

c. A crystal has L = 2H, C = 0.01 pF and R = 2 kΩ. Its mounting capacitance is 2 pF. Calculate its series and parallel resonating frequency. **(06 Marks)**

8 a. Explain the small signal model of the FET. **(04 Marks)**

b. Derive the expression for Z_i, Z_0 and A_v for FETSelf biased configuration (with R_S bypassed) **(06 Marks)**

c. For the Fig.Q8(c), $V_{GS} = -2.86V$ and $I_D = 4.56$ mA, find i) g_m ii) r_d iii) Z_i iv) Z_0 and v) A_V. Assume $I_{DSS} = 16$ mA, $V_p = -4V$ and $y_{os} = 25\ \mu\upsilon$. **(10 Marks)**

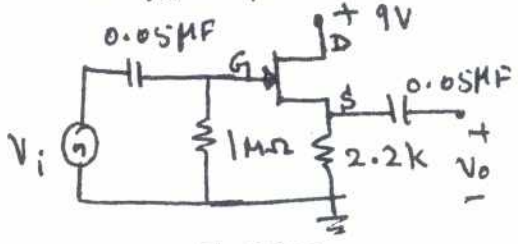

Fig.Q8(c)

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06ES33

Third Semester B.E. Degree Examination, June/July 2011
Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions selecting at least TWO from each Part.***

important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART A

1 a. Staircase light is controlled by two switches, one is at the top of the stair and other at the bottom of the stairs
   i) Make a truth table for this system
   ii) Write the logic equations in the SOP form
   iii) Realize the circuit using basic gates
   iv) Realize the circuit using minimum number of NAND gates. **(08 Marks)**

   b. Simplify by using Kornaugh map and realize the circuit using basic gates
   $f(a, b, c, d) = \pi(2, 3, 4, 6, 7, 10, 11, 12)$ **(08 Marks)**

   c. Show that $ab + \overline{ac} + a\overline{bc}(ab + c) = 1$ **(04 Marks)**

2 a. Simplify using Quine Mecluskey tabulation algorithm and find out the number of prime implicants.
   $f(a, b, c, d) = \Sigma(2, 3, 4, 5, 13, 15) + d(8, 9, 10, 11)$ **(10 Marks)**

   b. Simplify using MEV technique and implicant using basic gates
   $Y = \overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,\overline{C}D + A\,\overline{B}\,\overline{C}\,\overline{D} + A\,\overline{B}\,\overline{C}D + \overline{A}\,\overline{B}CD + \overline{A}B\overline{C}\,\overline{D} + ABCD + AB\overline{C}\,\overline{D}$
   (10 Marks)

3 a. With the aid of block diagram clearly distinguish between a decoder and encoder. **(05 Marks)**

   b. Design a single decode BCD adder and explain the methodology in detail. **(10 Marks)**

   c. Implement a full substractor using a decoder and two NAND gates. **(05 Marks)**

4 a. Implement $f(a, b, c, d) = \Sigma m(10, 1, 5, 6, 7, 9, 10, 15)$ using
   i) 8 : 1 MUX with a, b, c as select line
   ii) 4 : 1 MUX with a, b, as select lines **(08 Marks)**

   b. What is comparator? Design a two bit binary comparator. **(07 Marks)**

   c. Design a full adder using multiplexer
   For a full adder
   $S = \Sigma m(1, 2, 4, 7)$
   $C = \Sigma m(7, 5, 6, 7)$ **(05 Marks)**

PART B

5 a. Explain the operation of a simple S-R flip flop using NAND gates. **(10 Marks)**

   b. What is sequential circuit? Discuss the different types of sequential circuit. **(06 Marks)**

   c. Give the logic diagram
   i) Master slave J-K flip flop
   ii) Master slave S-R flip flop **(04 Marks)**

6 a. Describe the block diagram of a mod 7 twisted ring counter and explain its operation. Give the count sequence table and the decoding logic used to identify the various states. **(10 Marks)**

   b. Design a mod-5 synchronous binary counter using clocked J-K flip flops. **(10 Marks)**

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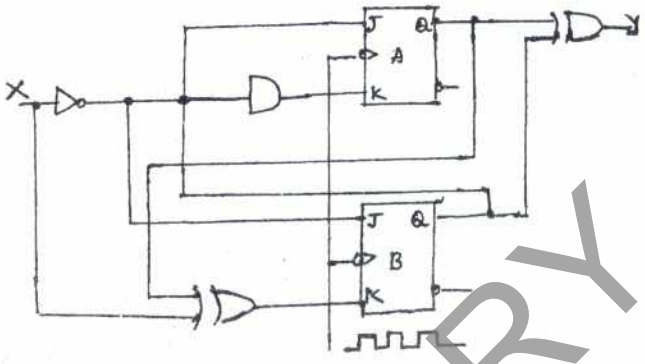
7 a. Construct the excitation table, transition table and state diagram for the Moore sequential circuit given below **(10 Marks)**



b. Compare Moore and Mealy models. **(04 Marks)**

c. Explain the Mealy model of a clocked synchronous sequential network. **(06 Marks)**

8 Write short notes on :

a. Working of switch debouncer using SR latch

b. Working of universal shift register

c. Shift registers

d. Race around condition in flip flops. **(20 Marks)**

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06ES34

Third Semester B.E. Degree Examination, June/July 2011
Network Analysis

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions selecting at least TWO questions from each part.***
2. Missing data may be suitably assumed.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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PART – A

1 a. Using source transformation and source shifting techniques, find voltage across 2Ω resistor in Fig.Q1(a). **(06 Marks)**

b. Find equivalent resistance at AB terminals in Fig.Q1(b). **(06 Marks)**

c. Find current in 2Ω resistors by Mesh analysis in Fig.Q1(c) **(08 Marks)**

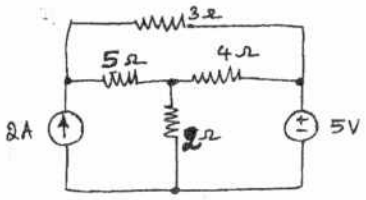

Fig.Q1(a)

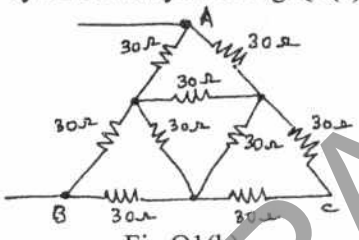

Fig.Q1(b)

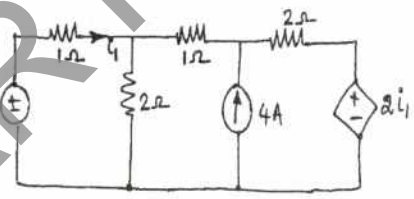

Fig.Q1(c)

2 a. Define the terms (i) graph, (ii) branch, (iii) node, (iv) tree, (v) link as referred to network topology. **(04 Marks)**

b. Write a tie-set schedule and then find all the branch currents for the circuit shown in Fig.Q2(b). **(08 Marks)**

c. Write the dual network for the network shown in Fig.Q2(c). Write the equations governing the given network and for its dual as well. **(08 Marks)**

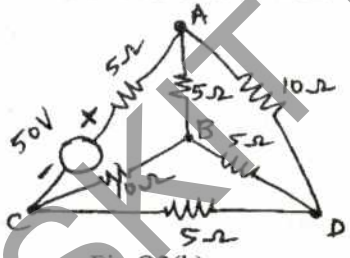

Fig.Q2(b)

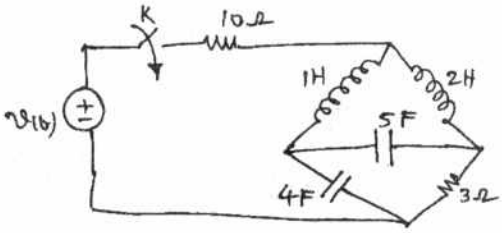

Fig.Q2(c)

3 a. Find V using the principle of superposition in network. State superposition theorem in Fig.Q3(a). **(10 Marks)**

b. State reciprocity theorem. Find i_x and hence verify reciprocity theorem for the network in Fig.Q3(b). **(10 Marks)**

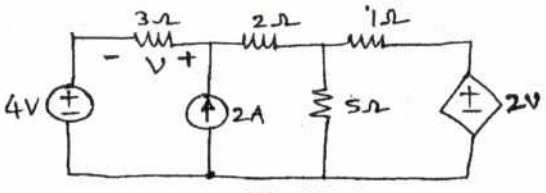

Fig.Q3(a)

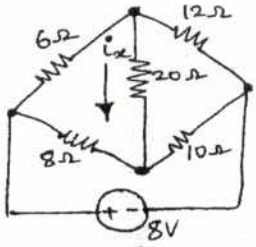

Fig.Q3(b)

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4 a. State Norton's theorem. Determine the Norton's equivalent circuit across AB terminals in the network of Fig.Q4(a). Hence determine current in 5Ω resistor. **(10 Marks)**

b. State maximum power transfer theorem for a variable impedance Z_L as load and prove the same. **(05 Marks)**

c. Find the value of Z_L for which maximum power transfer occurs in the circuit given in Fig.Q4(c). **(05 Marks)**

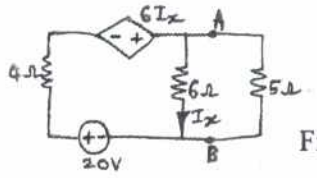


Fig.Q4(a)

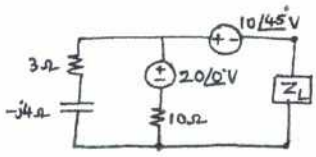


Fig.Q4(c)

PART – B

5 a. Explain the properties of RLC series resonant circuit. **(04 Marks)**

b. Find the resonant frequency in a series resonant circuit having an inductance of 50 mH and a condenser of 5μF. Find the resistance of the circuit if the circuit draws a current of 10 mA at resonance with a supply voltage of 50V. Also find the quality factor of the circuit. **(06 Marks)**

c. Explain in brief bandwidth and selectivity in series resonant circuit. A series RLC circuit has R = 2Ω, L = 2mH and C = 10μF. Calculate Q factor, the bandwidth, the resonant frequency and the half power frequencies f_1 and f_2. **(10 Marks)**

6 a. Explain the behaviour of R, L, C elements at the time of switching, at t = 0 both at t = 0+ and t = ∞. **(06 Marks)**

b. Determine i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t = 0+ when the switch K is moved from position 1 to 2 at t = 0 in the network shown in Fig.Q6(b). **(07 Marks)**

c. Determine V, $\frac{dV}{dt}$ and $\frac{d^2V}{dt^2}$ at t = 0+ when the switch K is opened at t = 0 in Fig.Q6(c). **(07 Marks)**

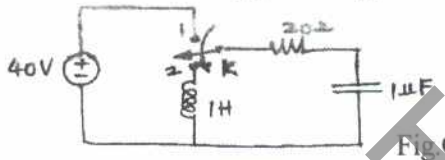
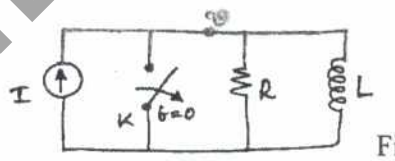


Fig.Q6(b)



R = 100Ω
L = 1H
I = 2A
Fig.Q6(c)

7 a. Find the current i(t) when switch K is opened at t = 0 with the circuit having reached steady state before the switching in Fig.Q7(a). Find current at t = 0.5 sec. **(10 Marks)**

b. Find the current i(t) assuming zero initial conditions when switch K is closed at t = 0; The excitation V(t) is a pulse of magnitude 10V and duration of 2 sec. Consider R = 10Ω, C = 2F. Refer Fig.Q7(b). **(10 Marks)**

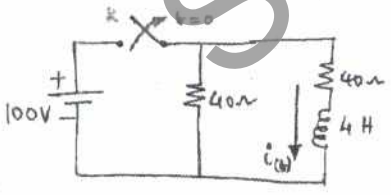
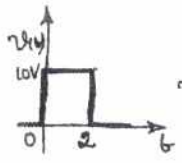


Fig.Q7(a)



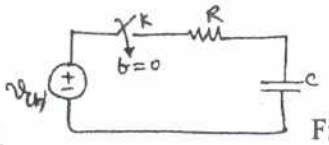


Fig.Q7(b)

8 a. Define Z parameters. Determine Z parameters for the network shown in Fig.Q8(a). **(10 Marks)**

b. Define transmission parameters. Determine the transmission parameters for the network shown in Fig.Q8(b). **(10 Marks)**

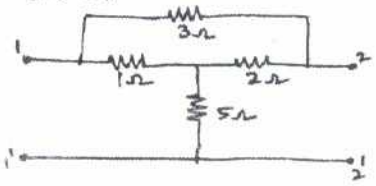


Fig.Q8(a)

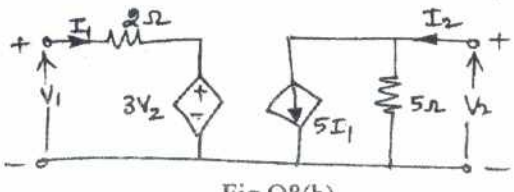


Fig.Q8(b)

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06IT35

Third Semester B.E. Degree Examination, June/July 2011
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***
selecting at least TWO questions from each part.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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PART – A

1 a. Define the following terms as applied to an electronic instrument :
i) Precision
ii) Accuracy
iii) Resolution
iv) Significant figures. **(08 Marks)**

b. Explain the multirange voltmeter using multipliers connected in series string. **(06 Marks)**

c. Calculate the value of the multiplier resistance on the 50V range of a DC voltmeter that uses a 200 μA meter movement with an internal resistance of 100 Ω. **(06 Marks)**

2 a. Explain the working of dual slope type digital voltmeter, with the help of a block diagram. **(06 Marks)**

b. A 4½ digit voltmeter is used for voltage measurements.
i) Find its resolution
ii) How would 12.98 V be displayed on a 10 V range?
iii) How would 0.6973 be displayed on 1V and 10 V ranges? **(06 Marks)**

c. Explain the operation of digital meter used for time measurement, with the help of block diagram. **(08 Marks)**

3 a. Explain the operation of vertical amplifier used in cathode ray oscilloscope, with the help of block diagram. **(06 Marks)**

b. With neat block diagram approach, explain the operation of dual beam cathode ray oscilloscope. **(06 Marks)**

c. Explain the operation of electronic switch used in CRO using basic block diagram, and circuit diagram. **(08 Marks)**

4 a. Explain the need for a delayed–time–base oscilloscope. Draw the block diagram of a delayed time base, and explain how it operates. **(10 Marks)**

b. Explain the basic operation of a digital storage oscilloscope, and discuss the relationship between sampling rate and bandwidth. **(10 Marks)**

PART – B

5 a. Explain the operation of conventional standard signal generator with the help of block diagram. **(06 Marks)**

b. Explain the operation of function – generator, with the help of bock diagram. **(06 Marks)**

c. Explain the operation of the frequency synthesizer uses a phase – locked – loop (PLL) system, with the help of block diagram. **(08 Marks)**

6 a. Explain the operation of the Maxwell's bridge, with a neat circuit diagram. Derive an expression for unknown values of resistance and inductance. What are the limitations of Maxwell's bridge? **(08 Marks)**

b. Find the equivalent parallel resistance and capacitance that causes a wien bridge to null with the following components (values)

$R_1 = 3.1\ k\Omega$

$C_1 = 5.2\ \mu F$

$R_2 = 25\ k\Omega$

$f = 2.5\ k\Omega$

$R_4 = 100\ k\Omega$. **(06 Marks)**

c. Write a note on Wagner's earth (ground) connection. **(06 Marks)**

7 a. Explain the operation of resistive position transducer, with neat diagram. **(06 Marks)**

b. What is resistance transducer? Explain briefly with diagram. Mention the advantages and disadvantages of the resistance transducer. **(08 Marks)**

c. Write a note on differential output transducers. **(06 Marks)**

8 a. Explain the operation of the photo–transistor with construction, symbol, output characteristics and relay circuit. **(06 Marks)**

b. Explain the operation of the measurement of power by means of bolometer bridge, with the help of suitable circuit. **(08 Marks)**

c. Write a note on light emitting diodes. **(06 Marks)**

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06ES36

Third Semester B.E. Degree Examination, June/July 2011
Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions selecting atleast TWO questions from each part.***

PART – A

1 a. State and explain Coulomb's law in vector form. **(05 Marks)**

b. State and explain Gauss law as applied to an electric field. **(05 Marks)**

c. Let a point charge $Q_1 = 25$ nc be located at A(4, -2, 7) and a charge $Q_2 = 60$ nc be at B(-3, 4, -2). Find $\vec{E}$ at C(1, 2, 3). Also find the direction of the electric field. Given $\epsilon_0 = 8.854 \times 10^{-12}$ F/m. **(10 Marks)**

2 a. Derive the boundary conditions to be satisfied at eh interface between a dielectric and a conductor in a static electric field. **(08 Marks)**

b. Obtain the expression for the work done in bringing a charge 'Q' from one point to another point along the radial path in an electric field due to an infinite line charge. Hence find the potential difference between that two points. **(06 Marks)**

c. Given the vector current density

$$\vec{J} = 10\rho^2 z\,\vec{a}_\rho - 4\rho\cos^2\phi\,\vec{a}_\phi \text{ mA/m}^2$$

Find the current flowing outward through the circular band $\rho = 3$, $0 < \phi < 2\pi$, $2 < z < 2.8$. **(06 Marks)**

3 a. Starting with point form of Gauss law deduce Poisson's and Laplace's equations. **(04 Marks)**

b. Using Poisson's equation obtain the expression for the junction potential in a P – n junction. **(08 Marks)**

c. Find E at P(3, 1, 2) for the field of two co-axial conducting cylinders V = 50 V at ρ = 2m, V = 20 V at ρ = 3 m. **(08 Marks)**

4 a. Obtain the expression for the magnetic flux density at any point on the axis of a circular current loop of n turns. **(07 Marks)**

b. State and prove stokes theorem. **(07 Marks)**

c. Calculate the value of the vector current density at point P(2, 3, 4) if

$$\vec{H} = x^2 z\,\vec{a} - y^2 x\,\vec{a}_z$$ **(06 Marks)**

PART – B

5 a. Derive the expression for the torque on a rectangular current loop carrying current I. **(07 Marks)**

b. Obtain the expression for reluctance in a series magnetic circuit. **(05 Marks)**

c. The point charge Q=18 nc has a velocity of 5×10^6 m/s in the direction $\vec{a}_v = 0.6\,\vec{a}_x + 0.75\,\vec{a}_y + 0.3\,\vec{a}_z$. Calculate the force exerted on the charge Q by the field $\vec{B} = -3\vec{a}_x + 4\vec{a}_y + 4\vec{a}_z$ mT. **(05 Marks)**

d. A coil of 500 turns is wound on a closed iron ring of mean radius 0.10 m and cross section area 3×10^{-4} m^2. Find the self inductance of the winding if the relative permeability of iron is 800. Give : $\mu_0 = 4\pi \times 10^{-7}$ H/m. **(03 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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6 a. Derive the integral and differential form of Faraday's law. **(07 Marks)**

b. Modify the Ampere's circuital law to suit the time varying condition. **(06 Marks)**

c. For the given medium $\epsilon = 4 \times 10^{-9}$ F/m and $\sigma = 0$. Find 'k' so that the following pair of fields satisfy Maxwell's equations.

$$\vec{E} = (20y - kt)\vec{a_x}\ V/m$$

$$\vec{H} = (y + 2\times10^{6}t)\vec{a_z}\ A/m$$

(07 Marks)

7 a. Starting from Maxwell's equations obtain the general wave equations in electric and magnetic fields. **(10 Marks)**

b. A uniform plane wave with 10 MHz frequency has average pointing vector 1 w/m^2. If the medium is perfect dielectric with $\mu_r = 2$ and $\epsilon_r = 3$, $\mu_0 = 4\pi \times 10^{-7}$ H/m, $\epsilon_0 = 8.854 \times 10^{-12}$ F/m;

Find :

i) Velocity

ii) Wavelength

iii) Intrinsic impedance

iv) rms value of electric field. **(10 Marks)**

8 a. Explain the reflection of plane waves at the surface of dielectrics at normal incidence. Hence derive the expression for reflection coefficient and transmission coefficient. **(10 Marks)**

b. A uniform plane wave at 100 MHz with electric field amplitude of 5 V/m travels in a medium of $\sigma = 0$, $\mu_r = 1$, $\epsilon_r = 9$. The wave propagates in x – y plane at 30° angle to x – axis. It is linearly polarized along z – axis. Write the phasor expression for electric field. Also determine values of λ_x, λ_y, v_{px}, v_{py}. Given $\mu_0 = 4\pi \times 10^{-7}$ H/m, $\epsilon_0 = 8.854 \times 10^{-12}$ F/m. **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June/July 2011
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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1 a. Express $\frac{(1+i)(2+i)}{3+i}$ in the form a + i b. **(05 Marks)**

b. Put the complex number $1-i\sqrt{3}$ in polar form. **(05 Marks)**

c. Simplify $\frac{(\cos 6\theta - i\sin 6\theta)^3(\cos 2\theta + i\sin 2\theta)^7}{(\cos 4\theta - i\sin 4\theta)^3}$. **(05 Marks)**

d. Find the cube roots of 1 – i. **(05 Marks)**

2 a. Find the n^{th} derivative of $e^{ax}\sin(bx + c)$. **(06 Marks)**

b. Find the n^{th} derivative of $\frac{x+3}{(x-1)(x+2)}$. **(07 Marks)**

c. If $y = e^{m\sin^{-1}x}$ then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+m^2)y_n = 0$. **(07 Marks)**

3 a. With usual notation, prove that $\tan\phi = r\frac{d\theta}{dr}$. **(06 Marks)**

b. Show that the curves $r = a(1+\cos\theta)$ and $r = a(1-\cos\theta)$ interest orthogonally. **(07 Marks)**

c. Expand $\log(1+x)$ in ascending power's of x as for as the terms containing x^4. **(07 Marks)**

4 a. If $u = e^{ax+by}f(ax-by)$, prove that $b\frac{\partial u}{\partial x} + a\frac{\partial u}{\partial y} = 2abu$. **(06 Marks)**

b. If u is a homogenous function of degree 'n' then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = nu$. **(07 Marks)**

c. If $u = x^2+y^2+z^2$, $v = xy+yz+zx$, $w = x+y+z$. find $J\left(\frac{u,v,w}{x,y,z}\right)$. **(07 Marks)**

5 a. Obtain the reduction formula for $\int\cos^n x\,dx$ where 'n' is a positive integer and hence evaluate $\int\cos^5 x\,dx$. **(06 Marks)**

b. Evaluate $\int_0^1 x^6\sqrt{1-x^2}\,dx$. **(07 Marks)**

c. Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dz\,dy\,dx$. **(07 Marks)**

6 a. Evaluate $\int_0^\infty x^{3/2} e^{-4x} dx$. **(06 Marks)**

b. Prove that $\beta(m,n) = \frac{\lceil(m).\lceil(n)}{\lceil(m+n)}$. **(07 Marks)**

c. Prove that $\int_0^{\pi/2} \sqrt{\sin\theta}\, d\theta \times \int_0^{\pi/2} \frac{1}{\sqrt{\sin\theta}} d\theta = \pi$. **(07 Marks)**

7 a. Solve $\frac{dy}{dx} = e^{3x-2y} + x^2 e^{-2y}$. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \cos(x+y+1)$. **(07 Marks)**

c. Solve $x^2y\, dx - (x^3 + y^3)\, dy = 0$. **(07 Marks)**

8 a. Solve $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = 0$. **(06 Marks)**

b. Solve $(D^2 + 3D + 2)y = x^2 + 3x + 1$. **(07 Marks)**

c. Solve $(D^2 + 4)y = \sin^2 2x$. **(07 Marks)**

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